FIG. 1

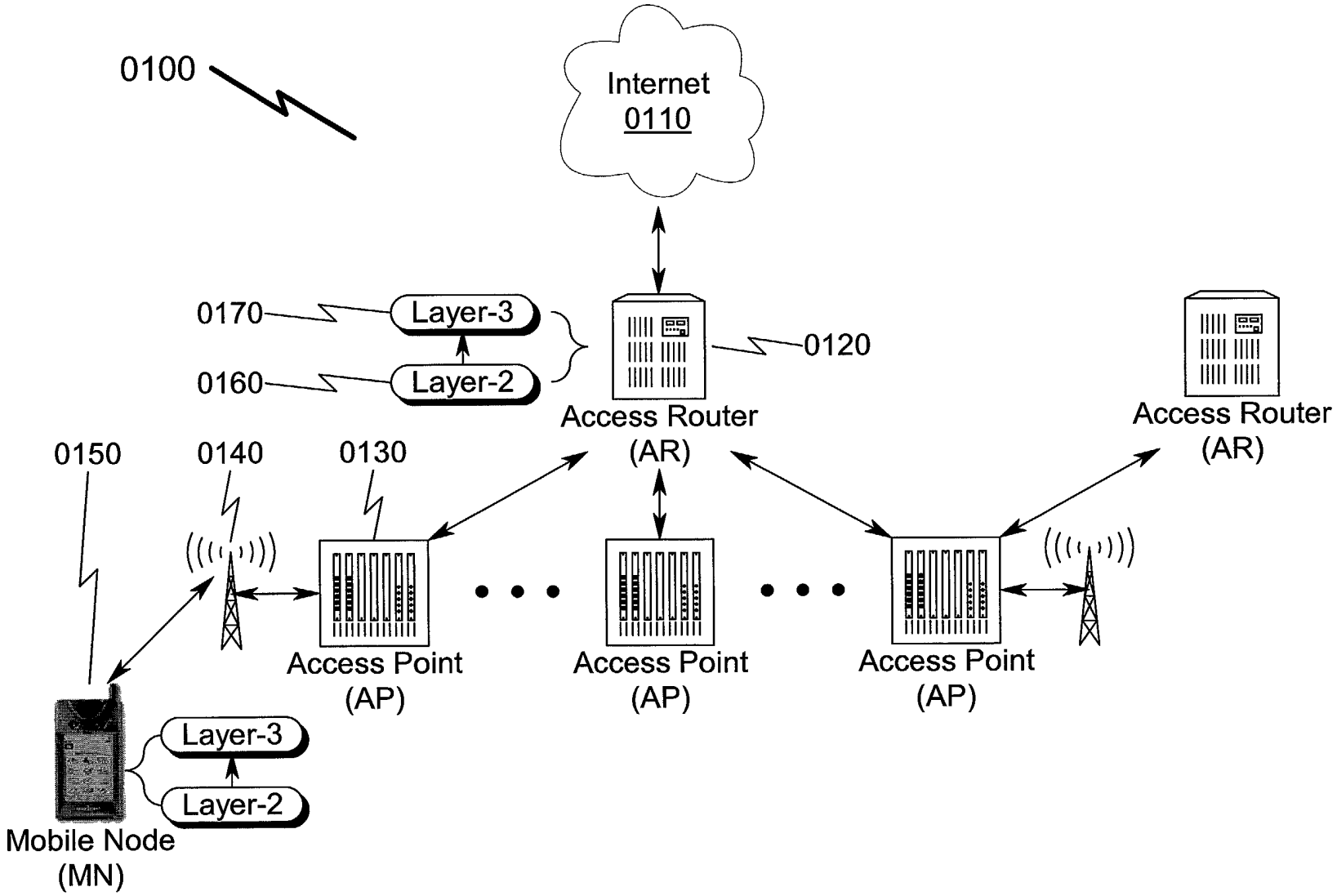

0100
Internet
0110
0170
Layer-3
0160
Layer-2
0120
Access Router
(AR)
Access Router
(AR)
0150
0140
0130
Access Point
(AP)
Access Point
(AP)
Access Point
(AP)
Layer-3
Layer-2
Mobile Node
(MN)

FIG. 2

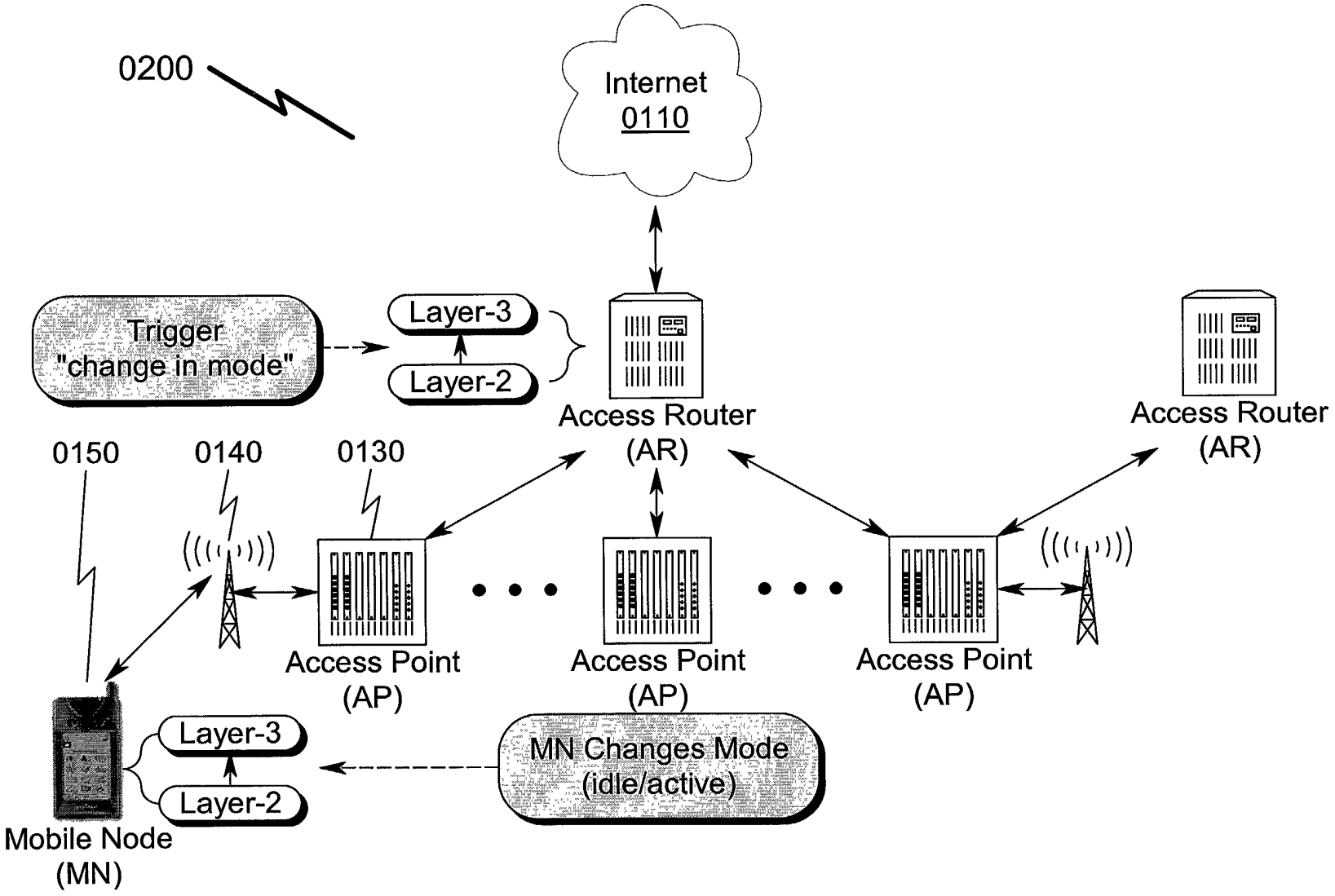

0200
Internet
0110
Trigger
"change in mode"
Layer-3
Layer-2
Access Router
(AR)
Access Router
(AR)
0150
0140
0130
Access Point
(AP)
Access Point
(AP)
Access Point
(AP)
Layer-3
Layer-2
MN Changes Mode
(idle/active)
Mobile Node
(MN)

FIG. 3

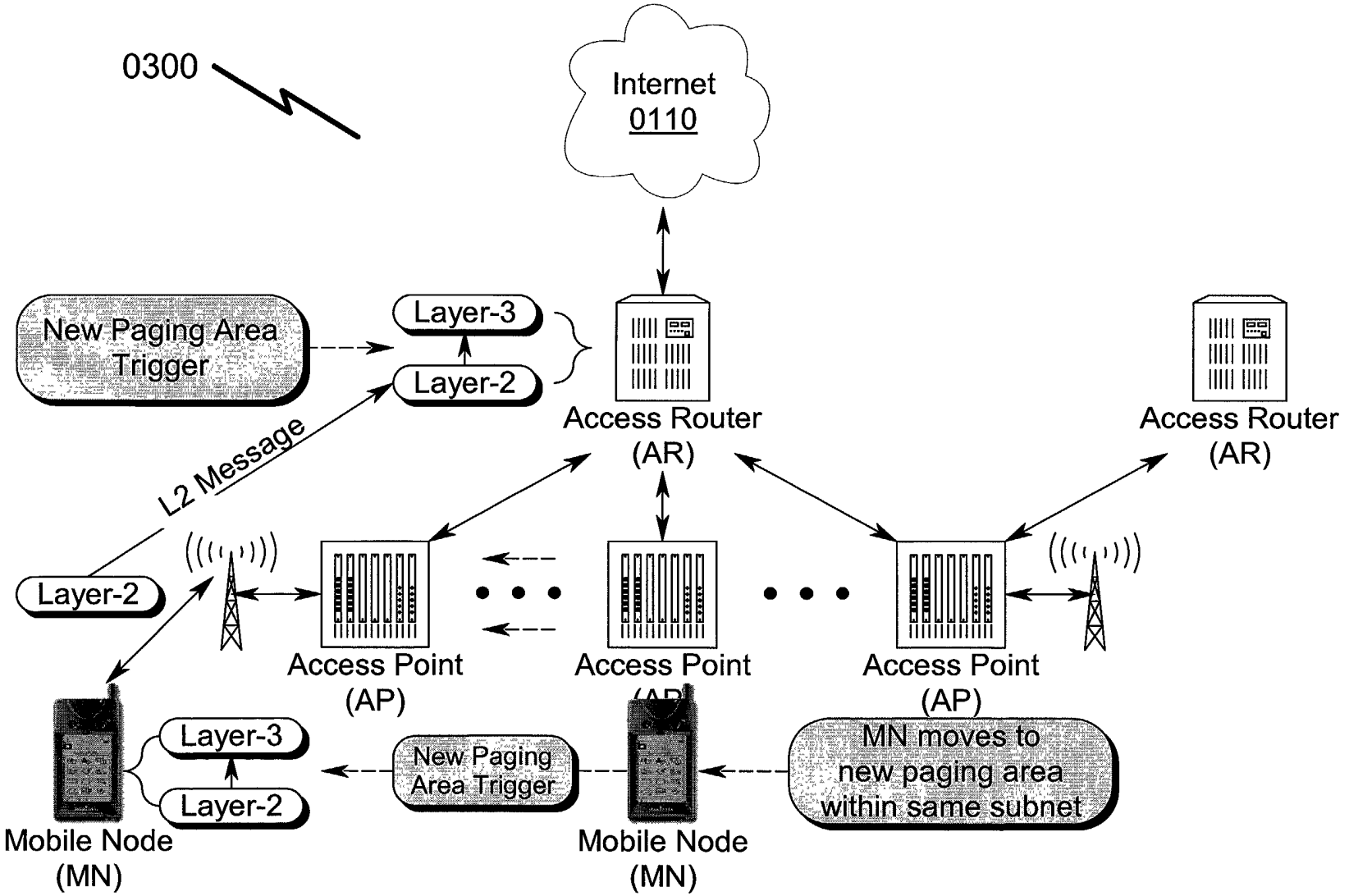

0300
Internet
0110
New Paging Area
Trigger
Layer-3
Layer-2
Access Router
(AR)
Access Router
(AR)
L2 Message
Layer-2
Access Point
(AP)
Access Point
(AP)
Access Point
(AP)
Layer-3
Layer-2
New Paging
Area Trigger
MN moves to
new paging area
within same subnet
Mobile Node
(MN)
Mobile Node
(MN)

FIG. 4

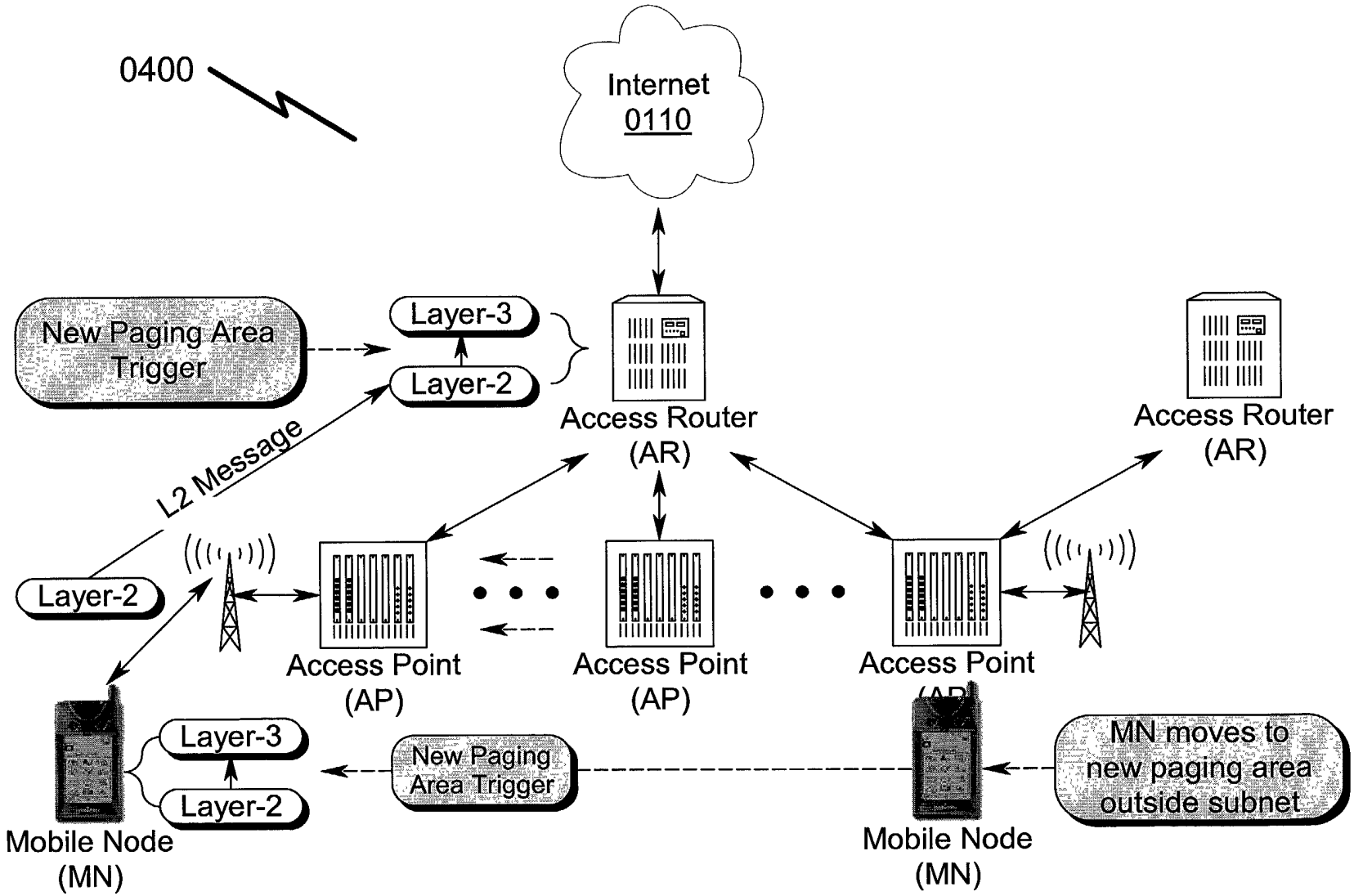

0400
Internet
0110
New Paging Area
Trigger
Layer-3
Layer-2
Access Router
(AR)
Access Router
(AR)
L2 Message
Layer-2
Access Point
(AP)
Access Point
(AP)
Access Point
(AP)
Layer-3
Layer-2
New Paging
Area Trigger
MN moves to
new paging area
outside subnet
Mobile Node
(MN)
Mobile Node
(MN)

FIG. 5

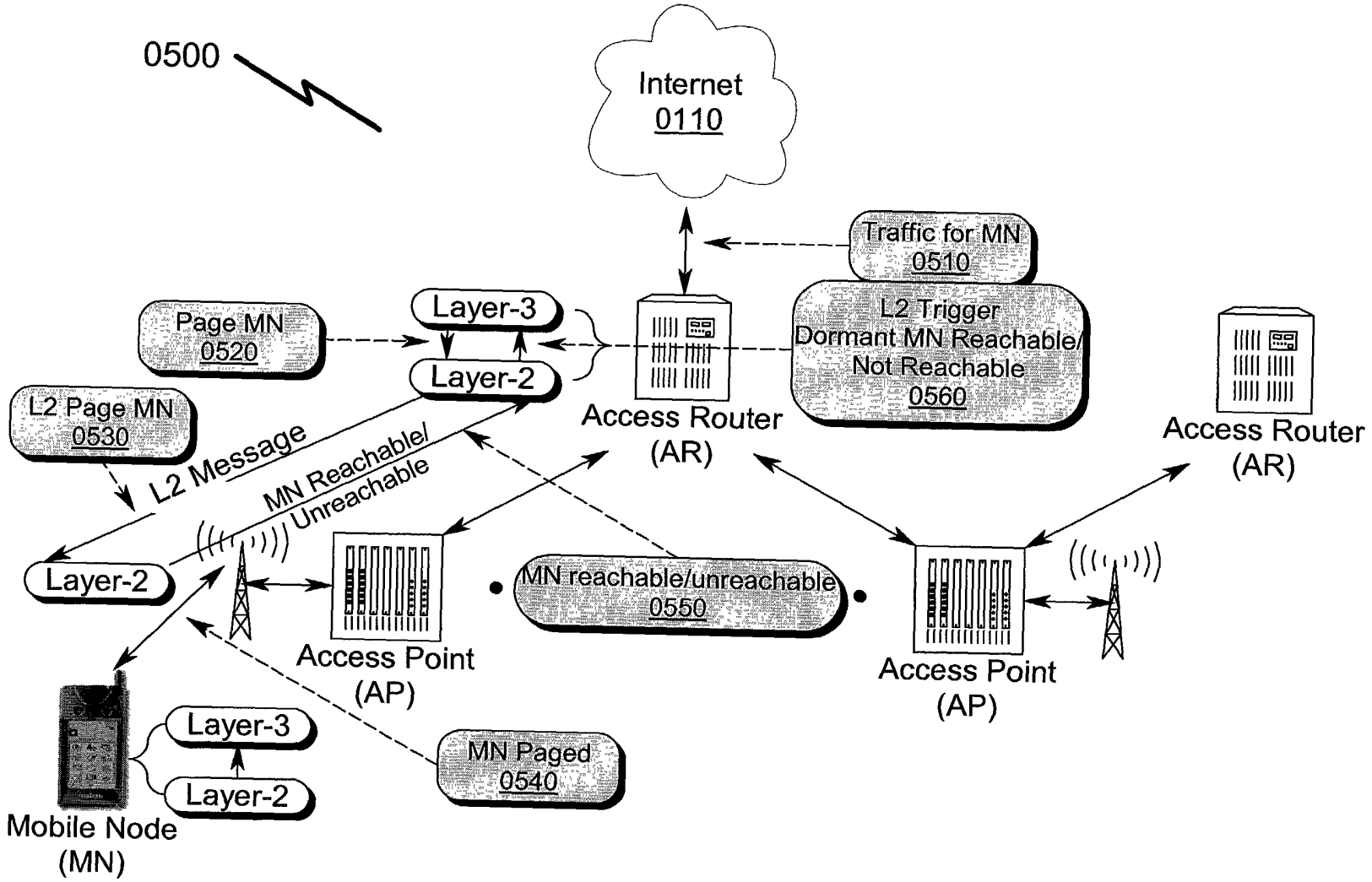

0500
Internet
0110
Traffic for MN
0510
Page MN
0520
Layer-3
Layer-2
L2 Trigger
Dormant MN Reachable/
Not Reachable
0560
Access Router
(AR)
Access Router
(AR)
L2 Page MN
0530
L2 Message
MN Reachable/
Unreachable
Layer-2
MN reachable/unreachable
0550
Access Point
(AP)
Access Point
(AP)
Layer-3
Layer-2
MN Paged
0540
Mobile Node
(MN)

FIG. 6

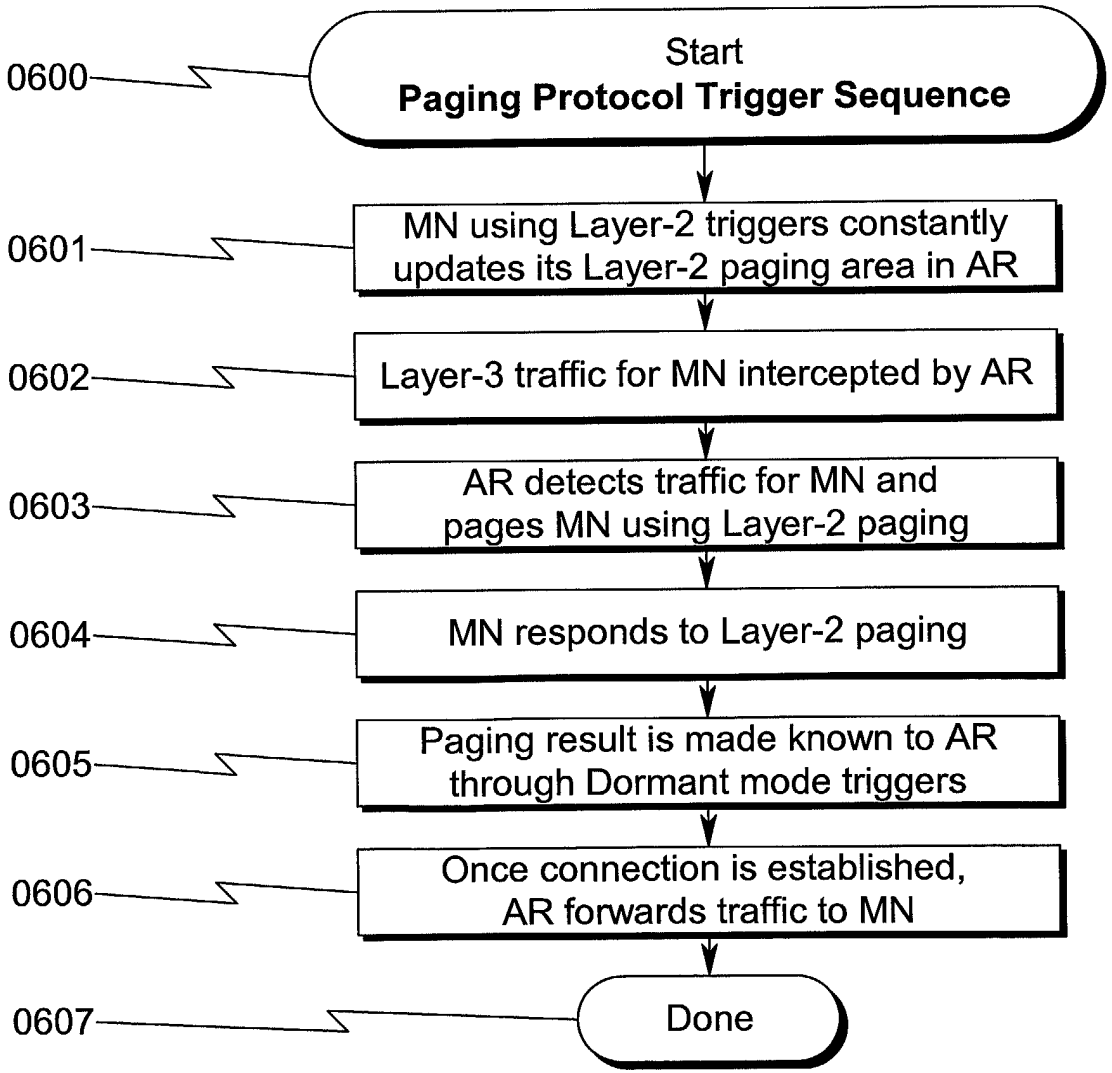

0600
Start
Paging Protocol Trigger Sequence
0601
MN using Layer-2 triggers constantly updates its Layer-2 paging area in AR
0602
Layer-3 traffic for MN intercepted by AR
0603
AR detects traffic for MN and pages MN using Layer-2 paging
0604
MN responds to Layer-2 paging
0605
Paging result is made known to AR through Dormant mode triggers
0606
Once connection is established, AR forwards traffic to MN
0607
Done

FIG. 7

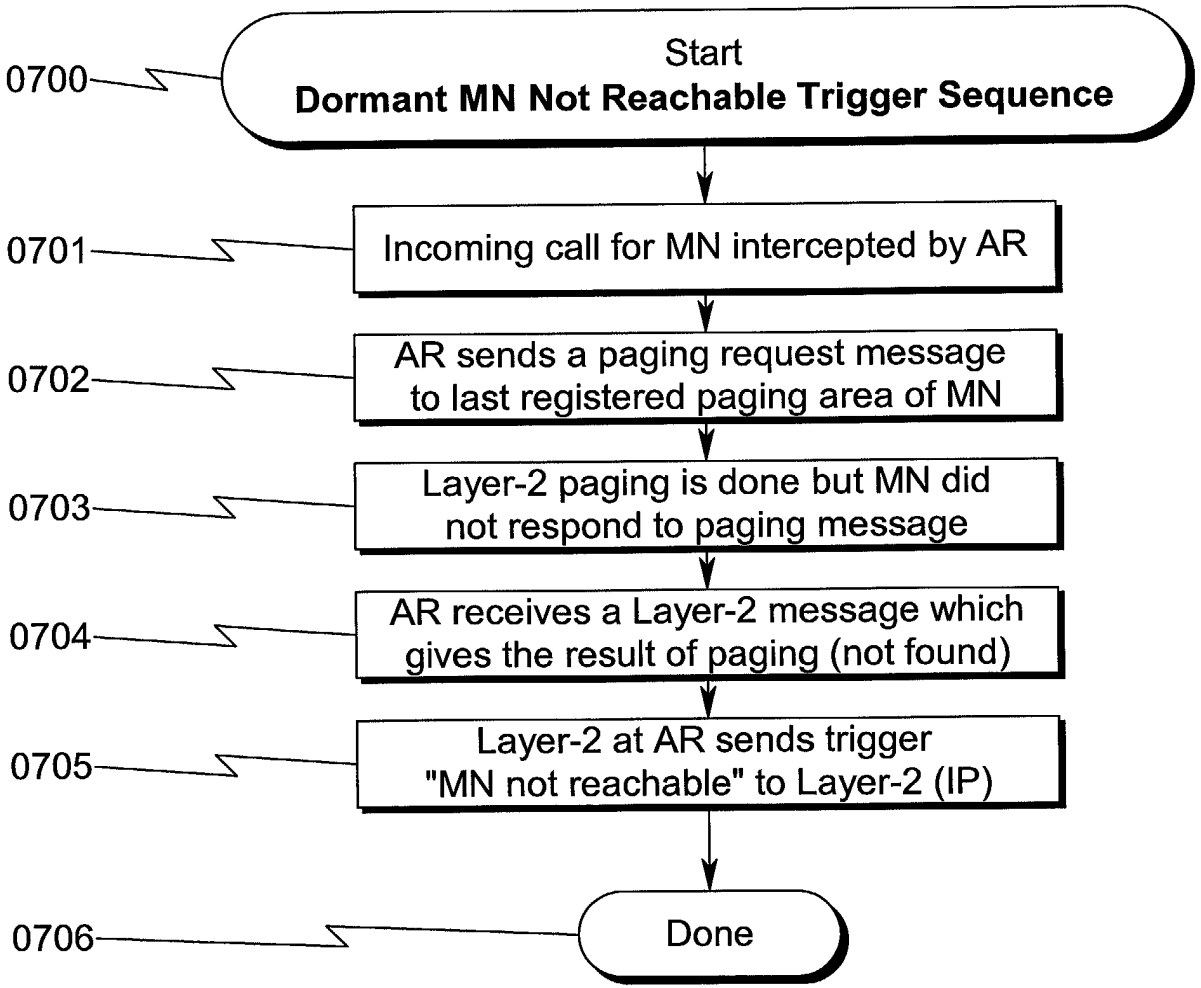

0700
Start
Dormant MN Not Reachable Trigger Sequence
0701
Incoming call for MN intercepted by AR
0702
AR sends a paging request message to last registered paging area of MN
0703
Layer-2 paging is done but MN did not respond to paging message
0704
AR receives a Layer-2 message which gives the result of paging (not found)
0705
Layer-2 at AR sends trigger "MN not reachable" to Layer-2 (IP)
0706
Done

FIG. 8

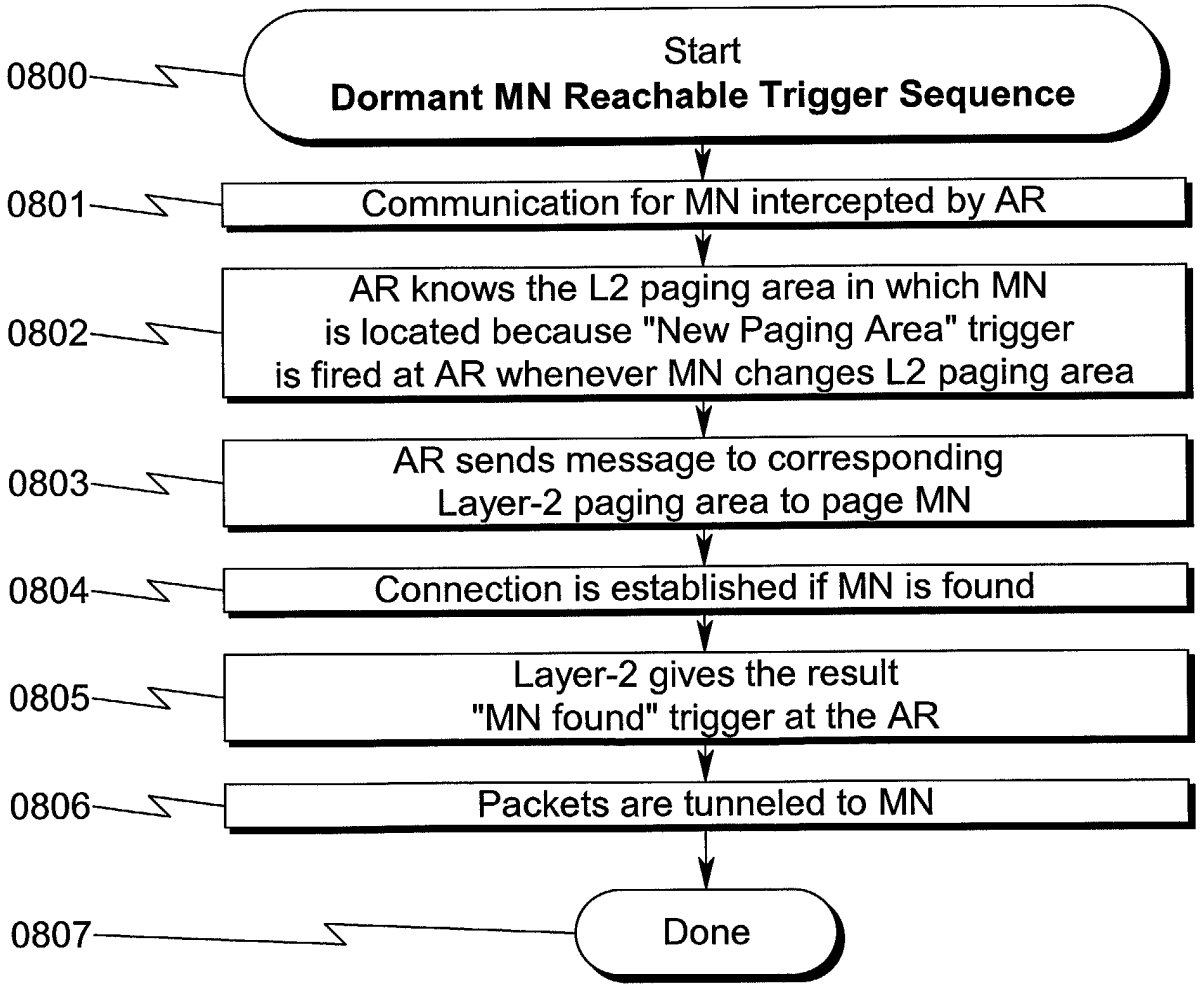
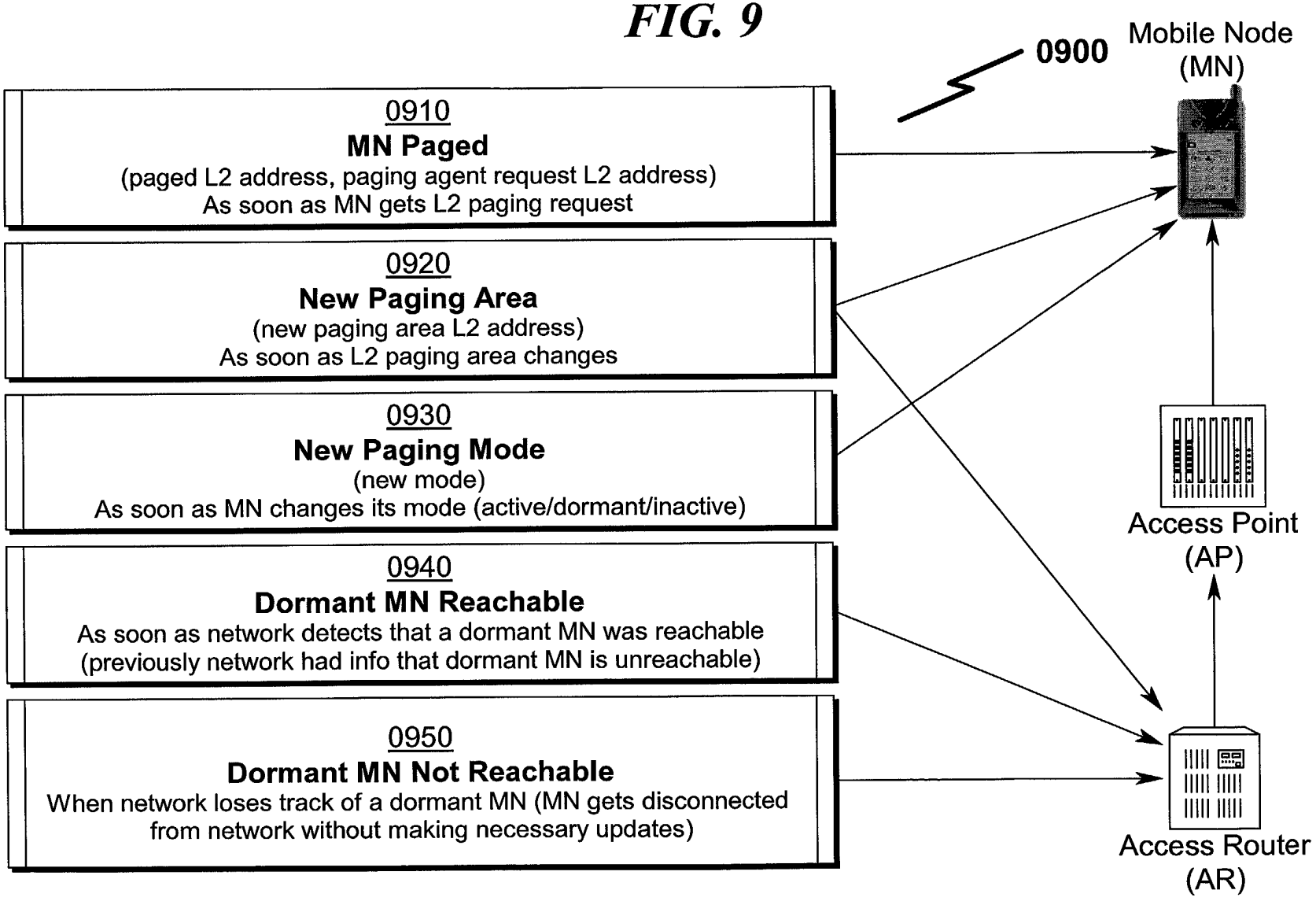

0800
Start
Dormant MN Reachable Trigger Sequence
0801
Communication for MN intercepted by AR
0802
AR knows the L2 paging area in which MN is located because "New Paging Area" trigger is fired at AR whenever MN changes L2 paging area
0803
AR sends message to corresponding Layer-2 paging area to page MN
0804
Connection is established if MN is found
0805
Layer-2 gives the result "MN found" trigger at the AR
0806
Packets are tunneled to MN
0807
Done

FIG. 9


0900
Mobile Node
(MN)
0910
MN Paged
(paged L2 address, paging agent request L2 address)
As soon as MN gets L2 paging request
0920
New Paging Area
(new paging area L2 address)
As soon as L2 paging area changes
0930
New Paging Mode
(new mode)
As soon as MN changes its mode (active/dormant/inactive)
0940
Dormant MN Reachable
As soon as network detects that a dormant MN was reachable
(previously network had info that dormant MN is unreachable)
0950
Dormant MN Not Reachable
When network loses track of a dormant MN (MN gets disconnected
from network without making necessary updates)
Access Point
(AP)
Access Router
(AR)

20520 0969501

FIG. 10

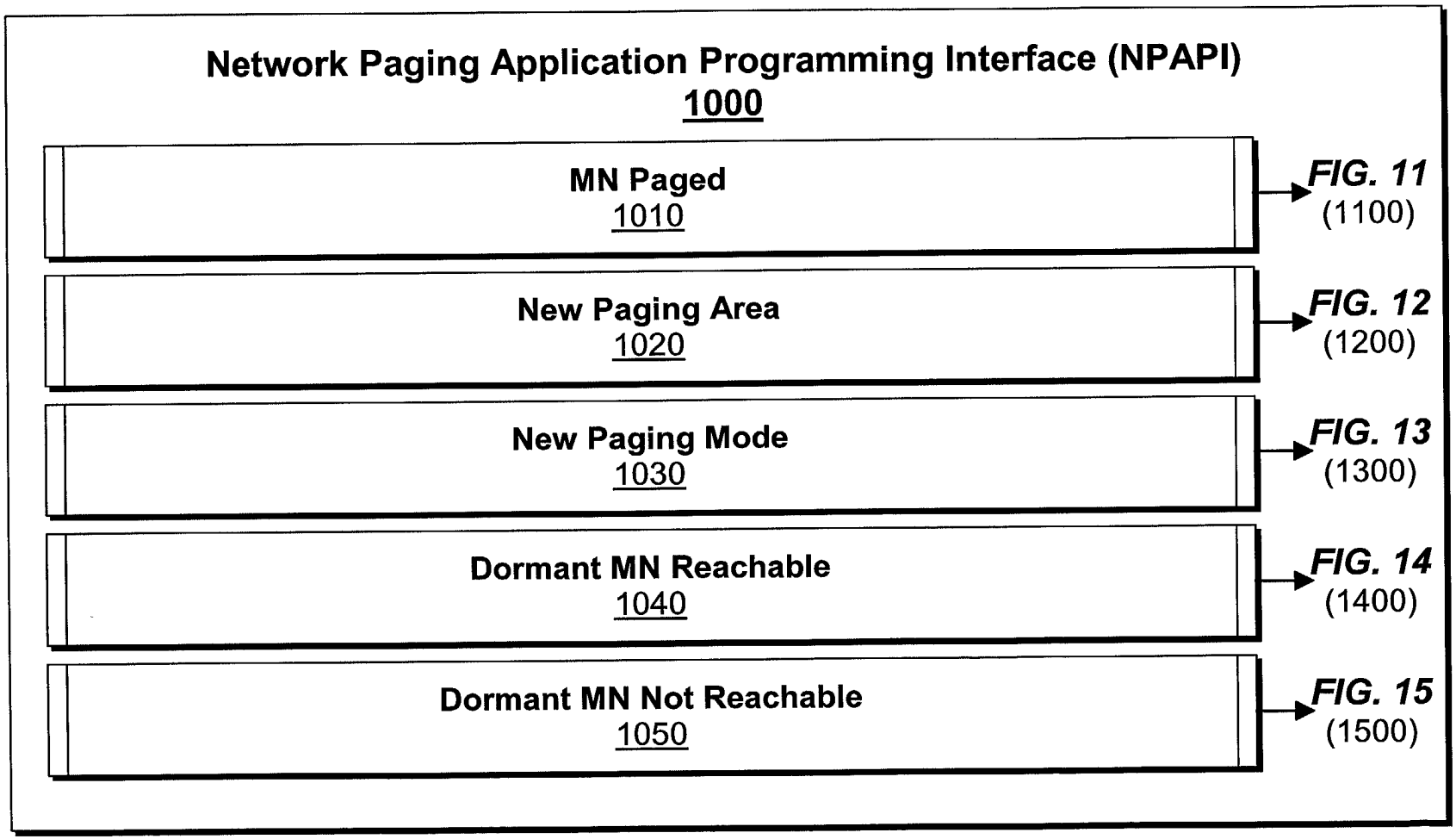


FIG. 11

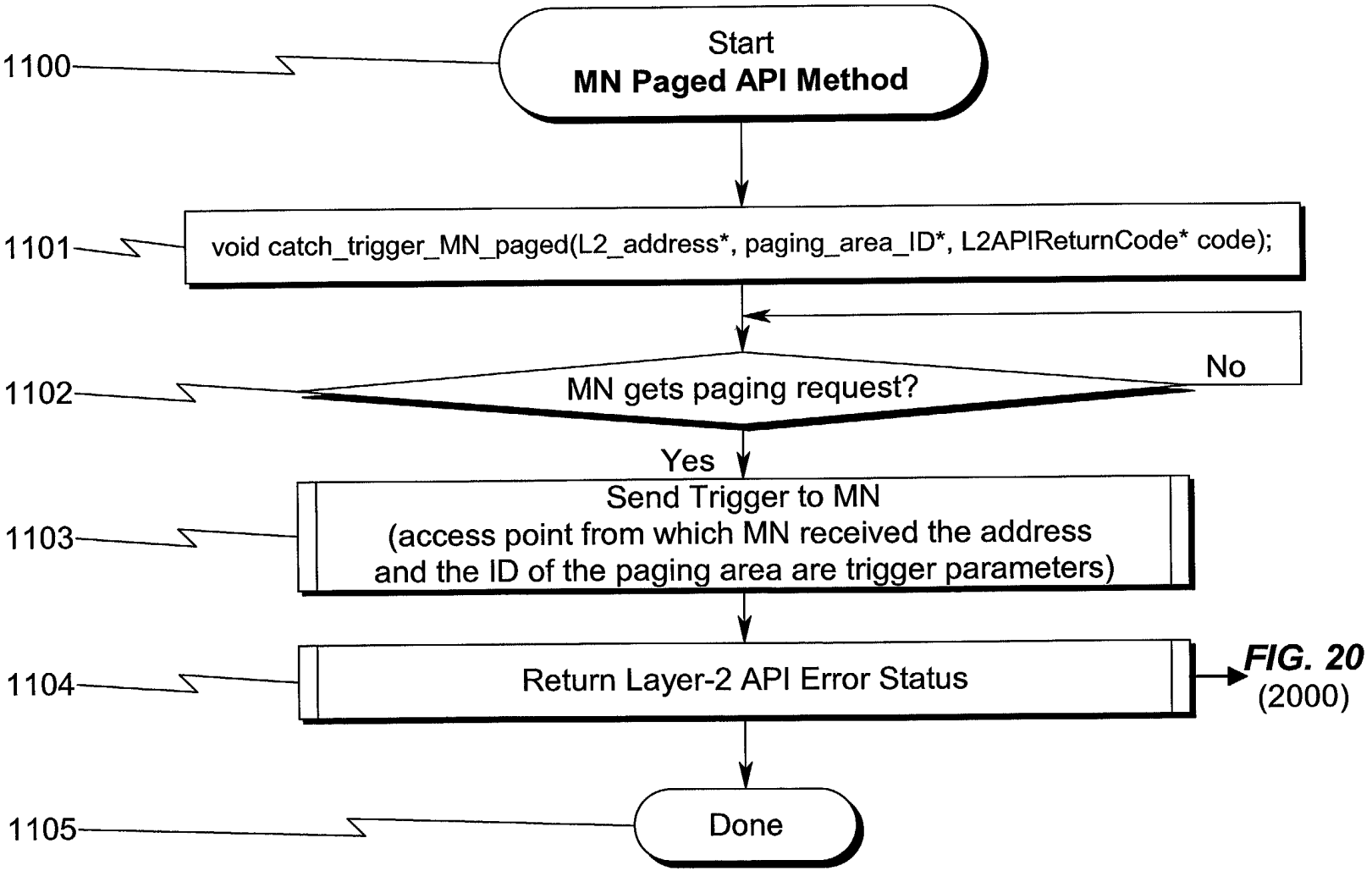


FIG. 20
(2000)

FIG. 12

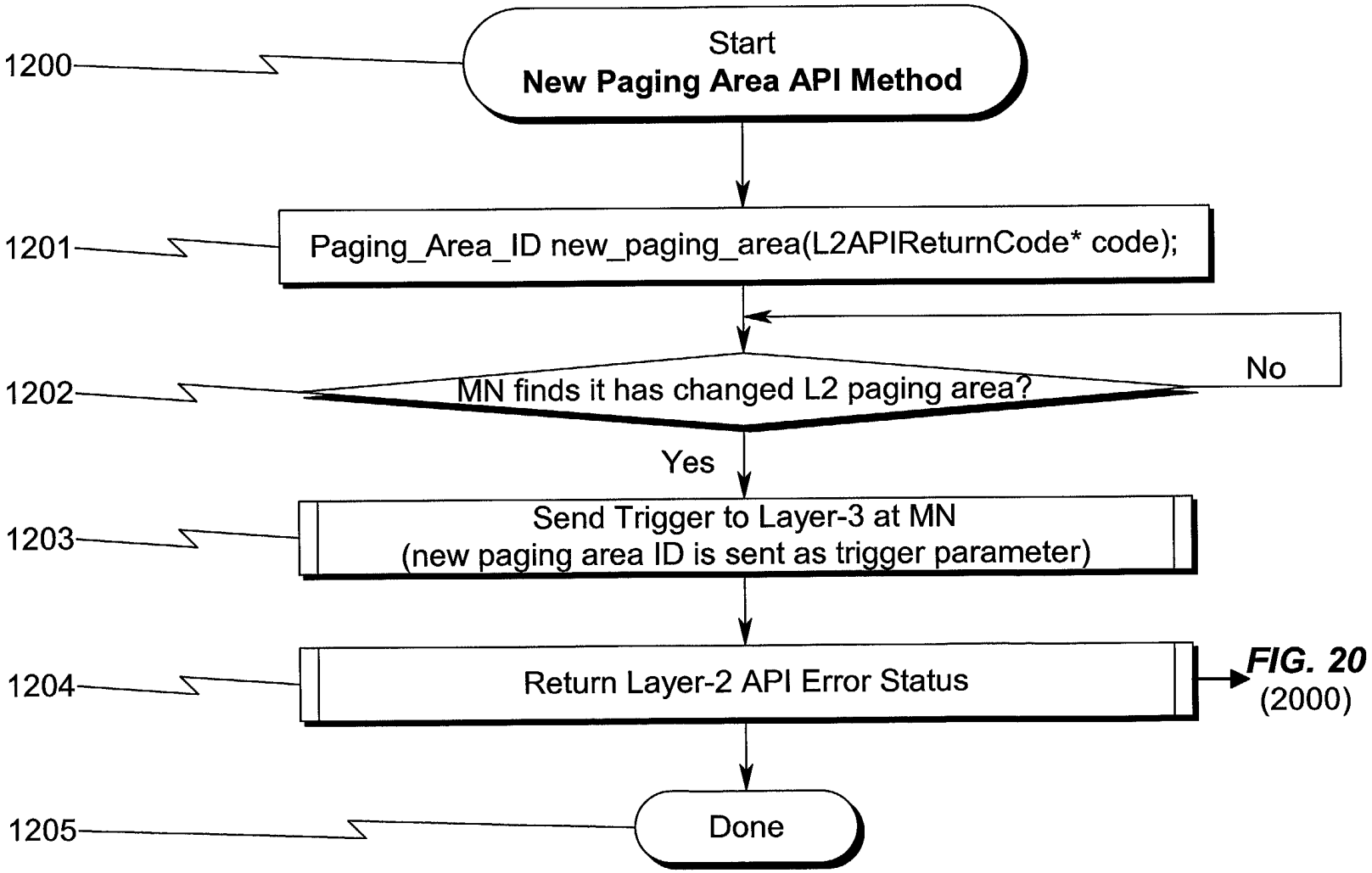


FIG. 20
(2000)

FIG. 13

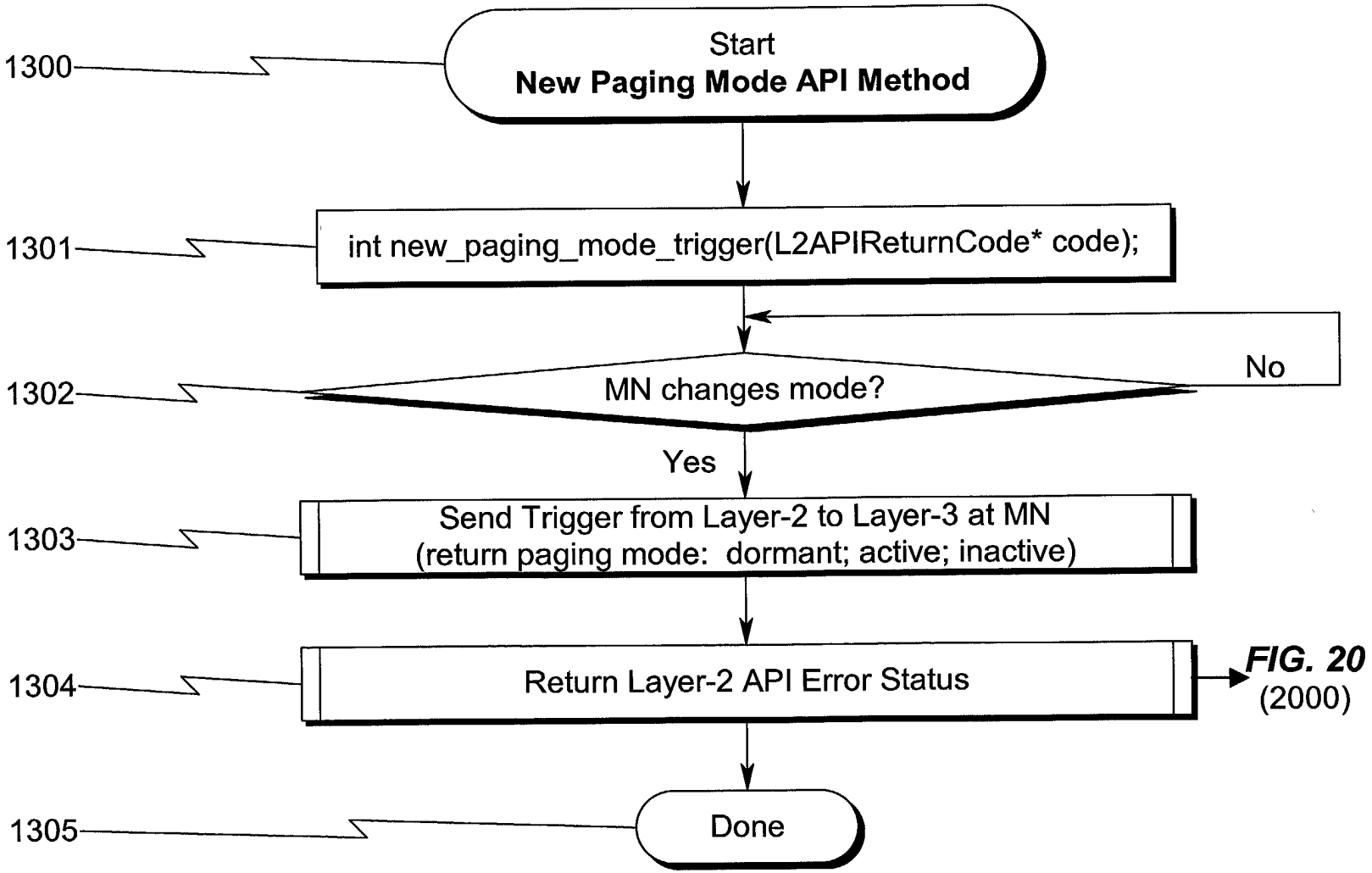


FIG. 20
(2000)

FIG. 14

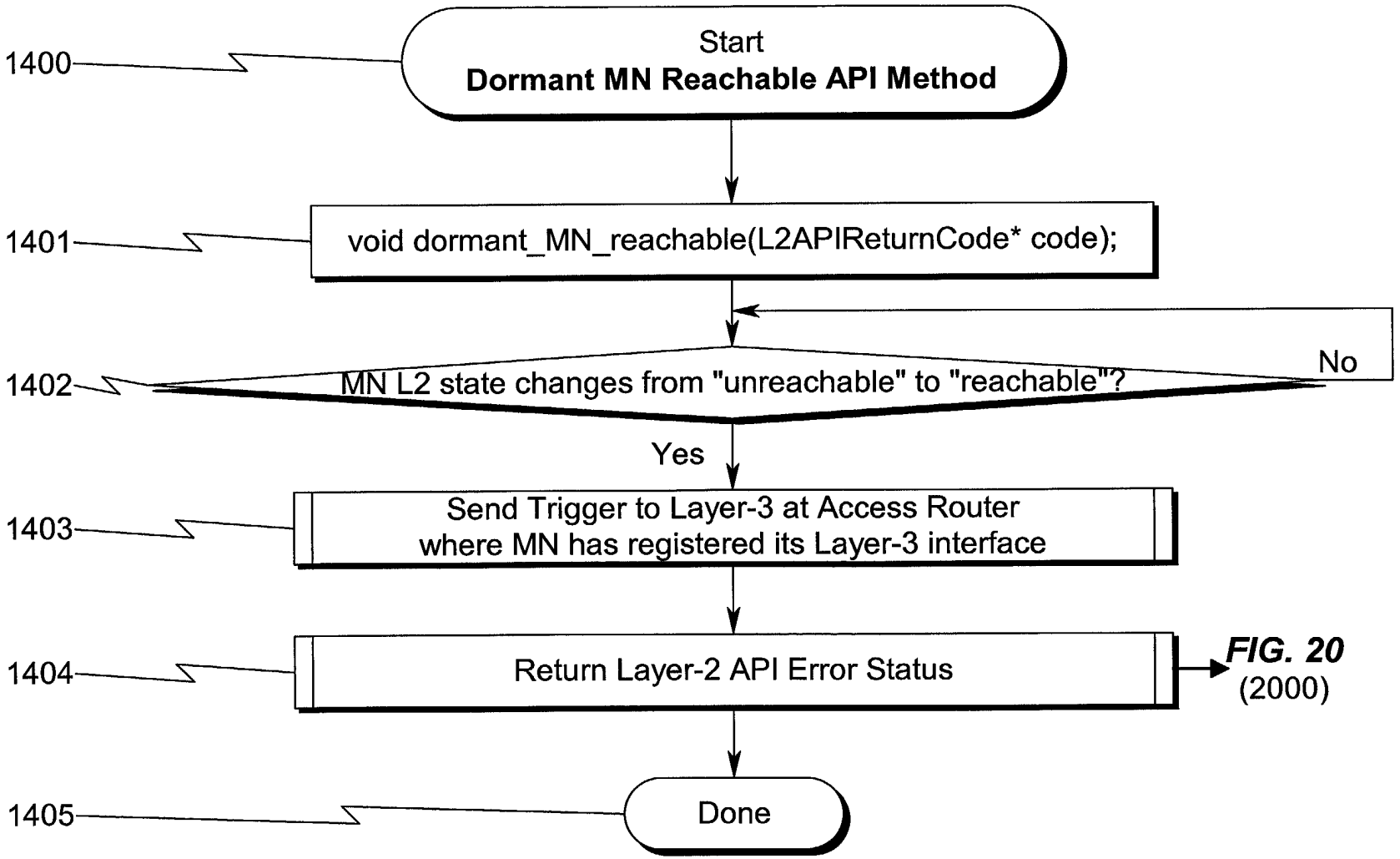

1400
Start
Dormant MN Reachable API Method
1401
void dormant_MN_reachable(L2APIReturnCode* code);
1402
MN L2 state changes from "unreachable" to "reachable"?
No
Yes
1403
Send Trigger to Layer-3 at Access Router
where MN has registered its Layer-3 interface
1404
Return Layer-2 API Error Status
FIG. 20
(2000)
1405
Done

FIG. 15

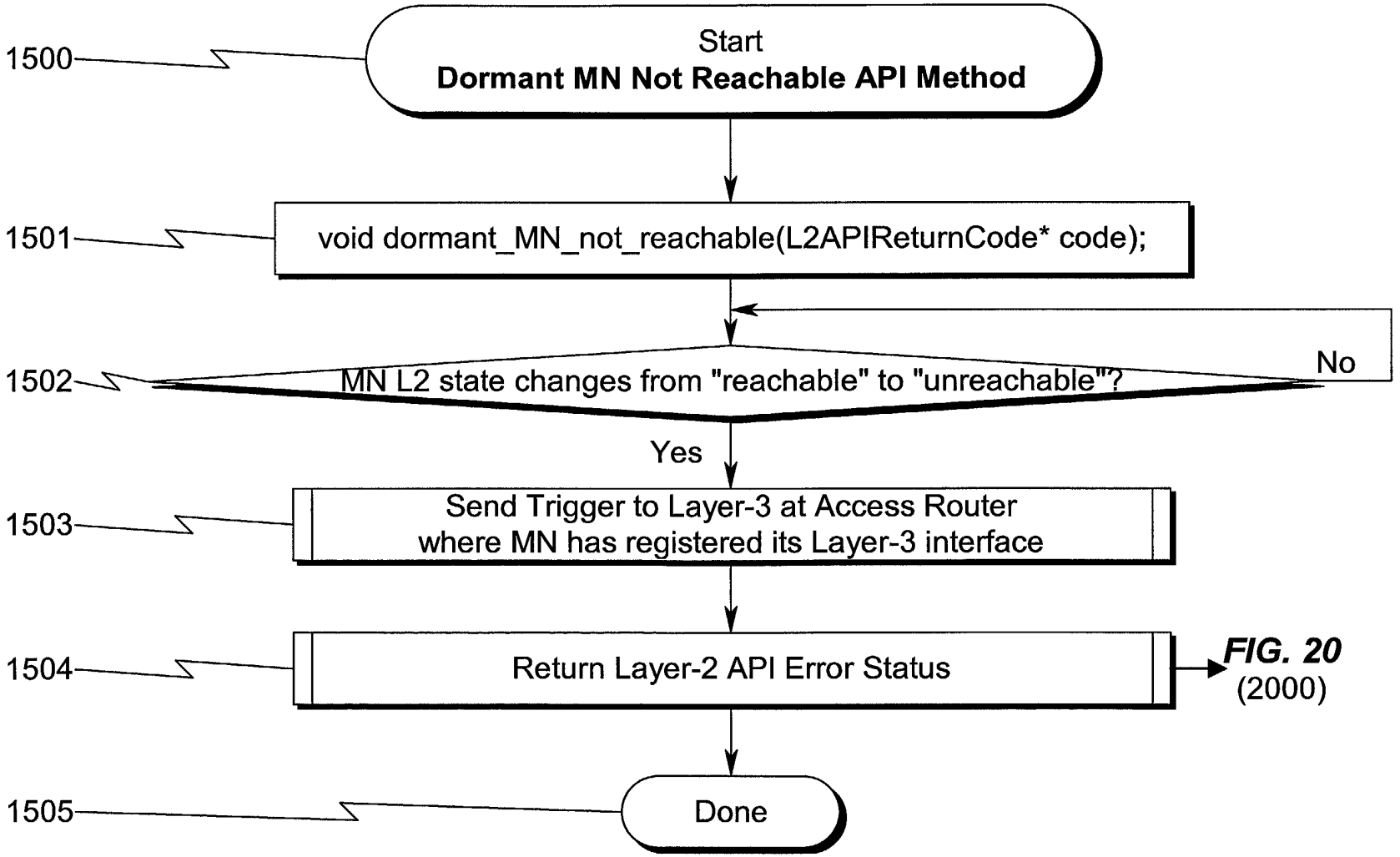


FIG. 20
(2000)

FIG. 16

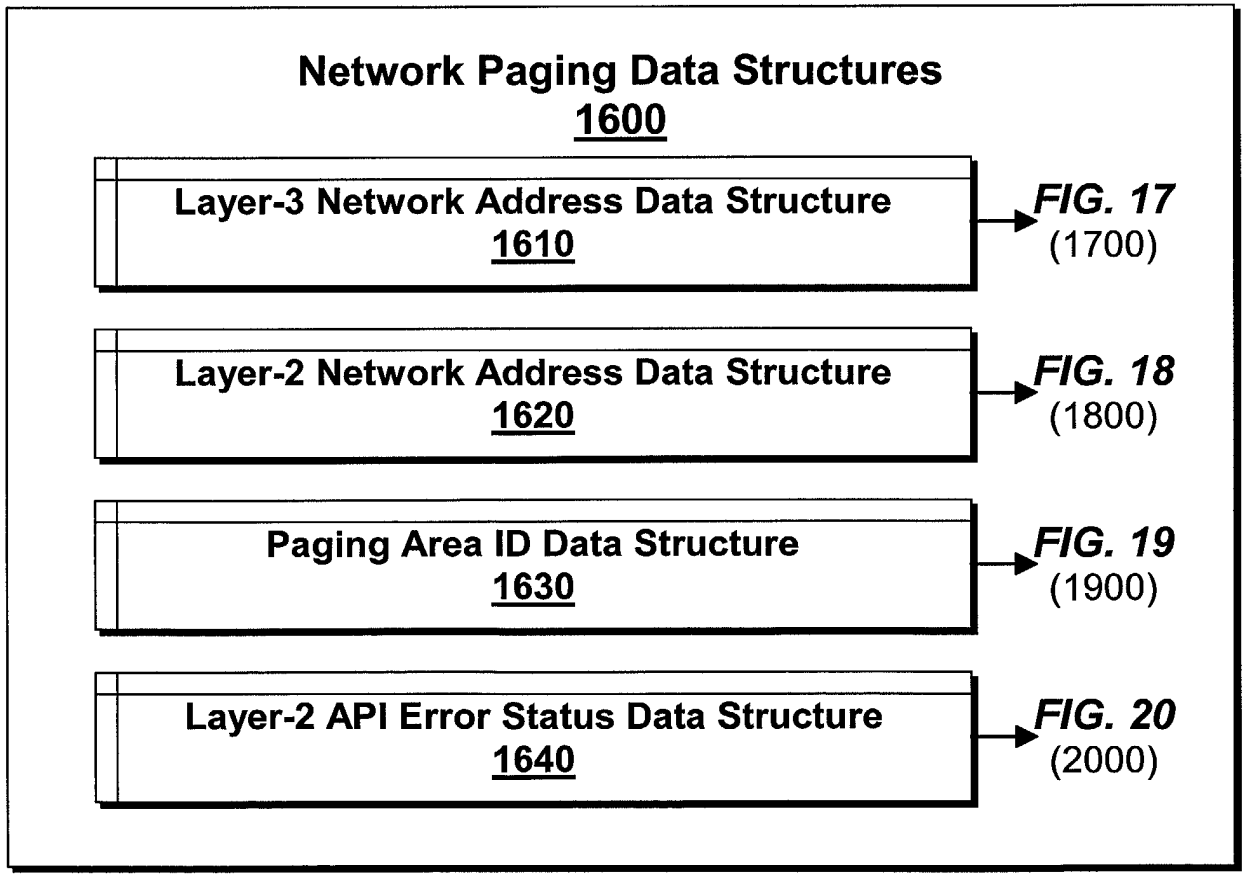

Network Paging Data Structures
1600
Layer-3 Network Address Data Structure
1610
FIG. 17
(1700)
Layer-2 Network Address Data Structure
1620
FIG. 18
(1800)
Paging Area ID Data Structure
1630
FIG. 19
(1900)
Layer-2 API Error Status Data Structure
1640
FIG. 20
(2000)

FIG. 17

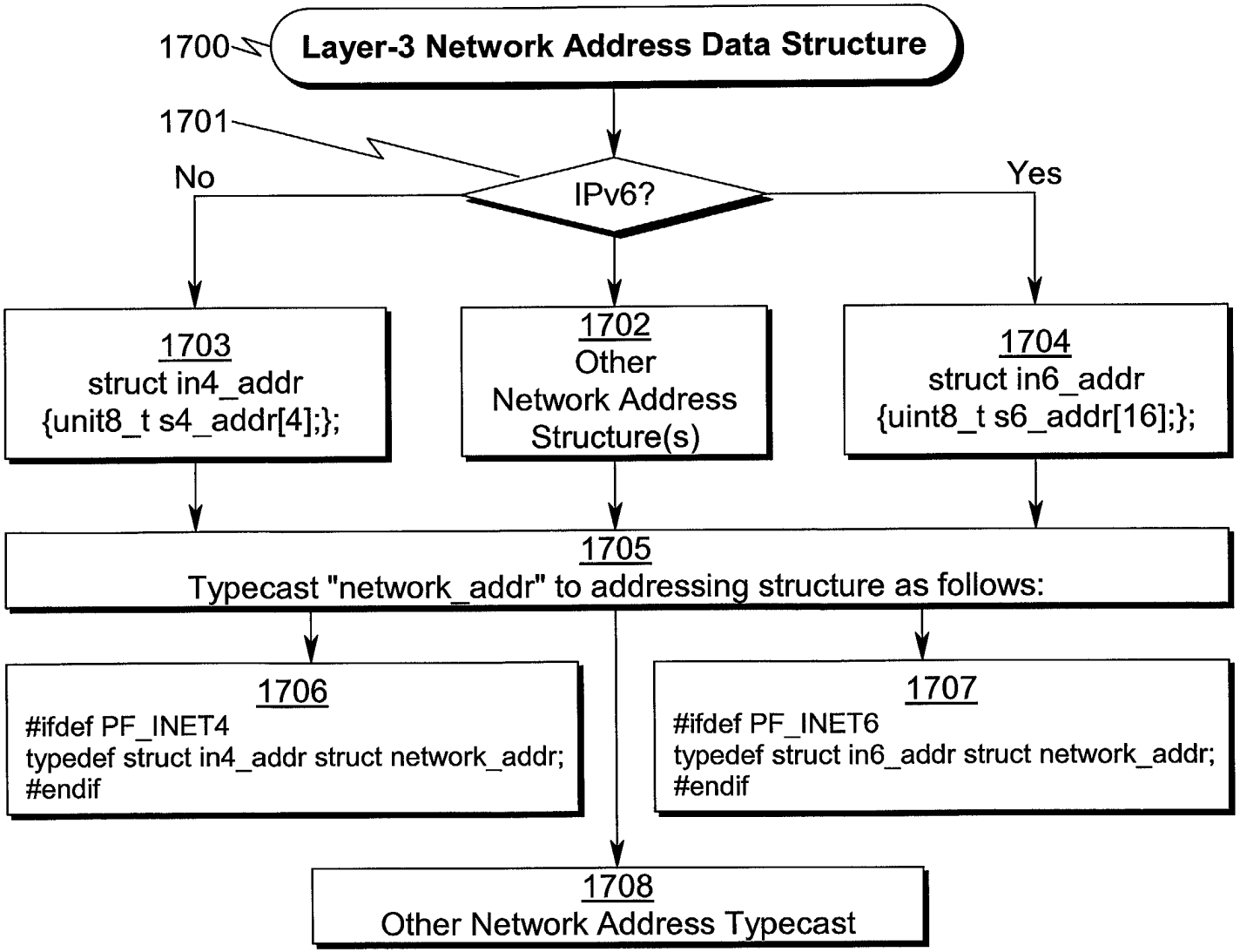

1700
Layer-3 Network Address Data Structure
1701
IPv6?
No
Yes
1703
struct in4_addr
{unit8_t s4_addr[4];};
1702
Other
Network Address
Structure(s)
1704
struct in6_addr
{uint8_t s6_addr[16];};
1705
Typecast "network_addr" to addressing structure as follows:
1706
#ifdef PF_INET4
typedef struct in4_addr struct network_addr;
#endif
1707
#ifdef PF_INET6
typedef struct in6_addr struct network_addr;
#endif
1708
Other Network Address Typecast

FIG. 18

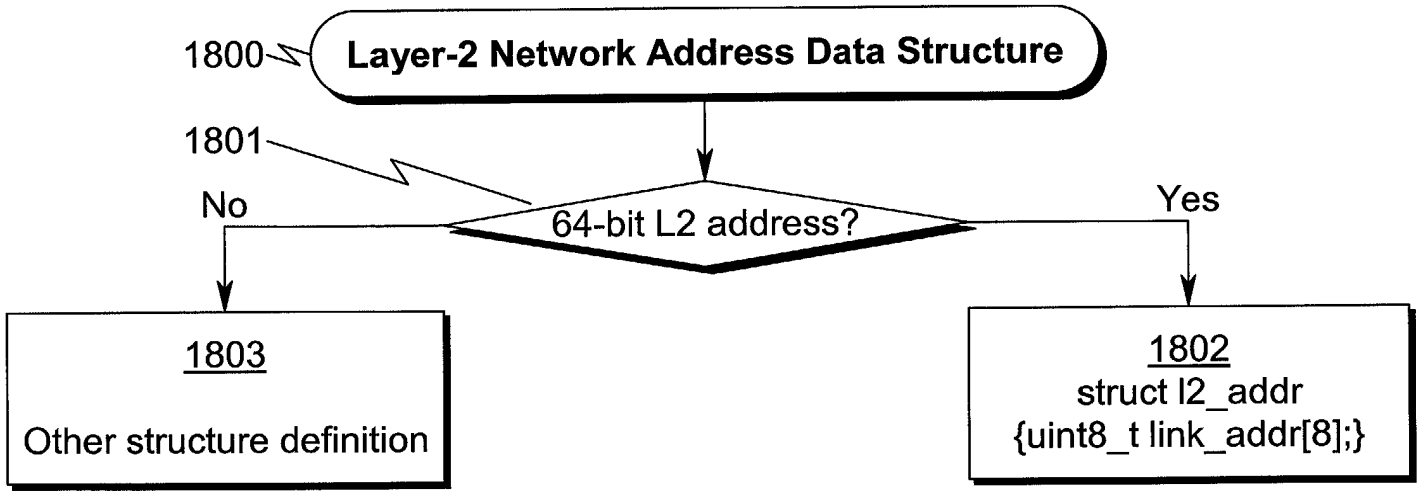

1800
Layer-2 Network Address Data Structure
1801
64-bit L2 address?
No
Yes
1803
Other structure definition
1802
struct l2_addr
{uint8_t link_addr[8];}

FIG. 19

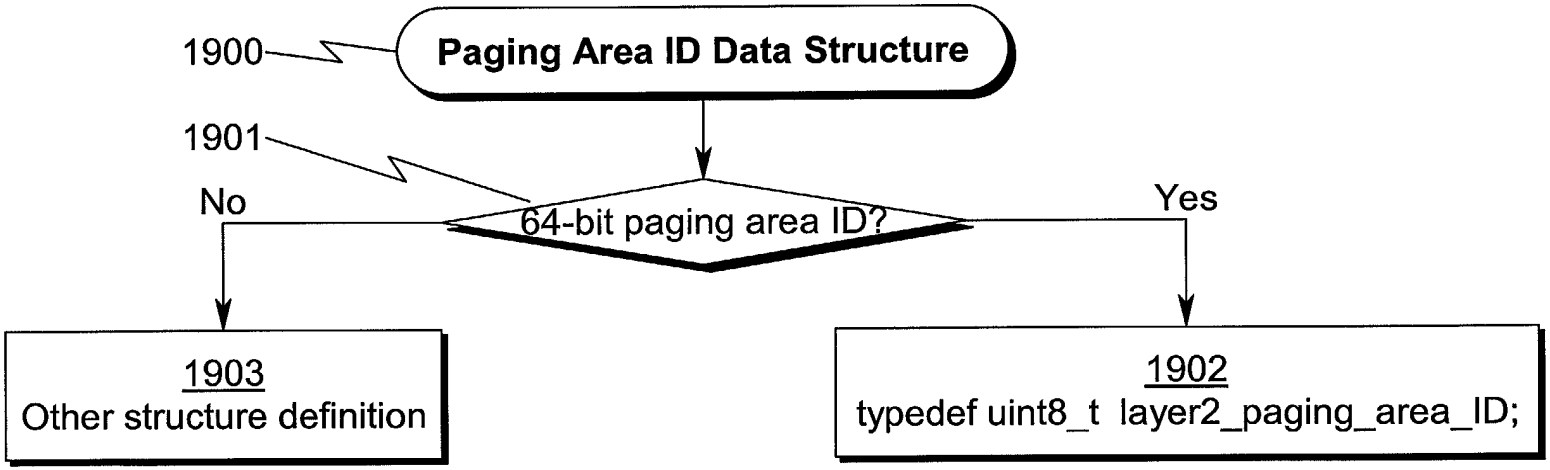

1900
Paging Area ID Data Structure
1901
64-bit paging area ID?
No
Yes
1903
Other structure definition
1902
typedef uint8_t layer2_paging_area_ID;

FIG. 20

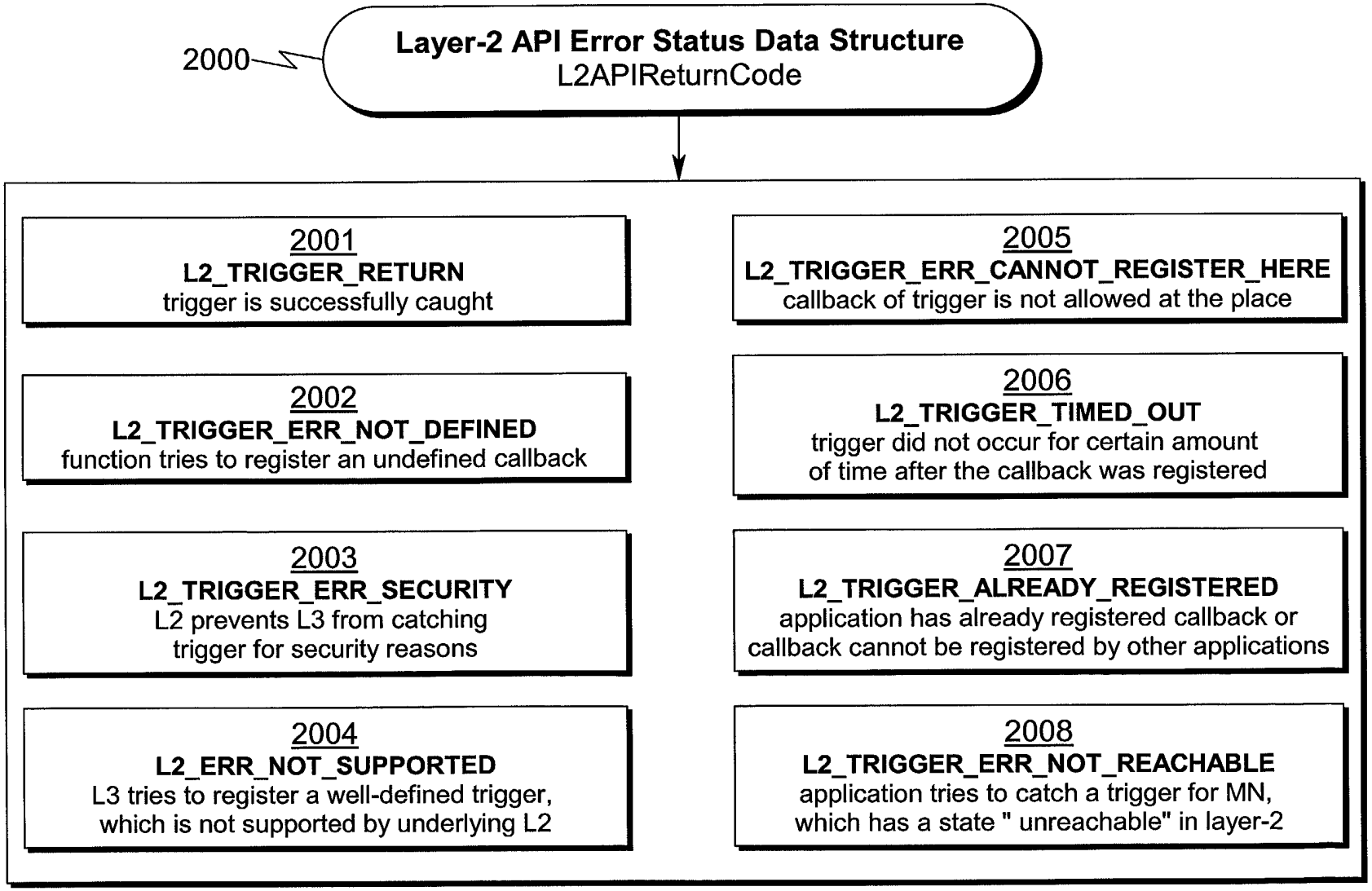

2000
Layer-2 API Error Status Data Structure
L2APIReturnCode
2001
L2_TRIGGER_RETURN
trigger is successfully caught
2002
L2_TRIGGER_ERR_NOT_DEFINED
function tries to register an undefined callback
2003
L2_TRIGGER_ERR_SECURITY
L2 prevents L3 from catching
trigger for security reasons
2004
L2_ERR_NOT_SUPPORTED
L3 tries to register a well-defined trigger,
which is not supported by underlying L2
2005
L2_TRIGGER_ERR_CANNOT_REGISTER_HERE
callback of trigger is not allowed at the place
2006
L2_TRIGGER_TIMED_OUT
trigger did not occur for certain amount
of time after the callback was registered
2007
L2_TRIGGER_ALREADY_REGISTERED
application has already registered callback or
callback cannot be registered by other applications
2008
L2_TRIGGER_ERR_NOT_REACHABLE
application tries to catch a trigger for MN,
which has a state " unreachable" in layer-2

FIG. 21

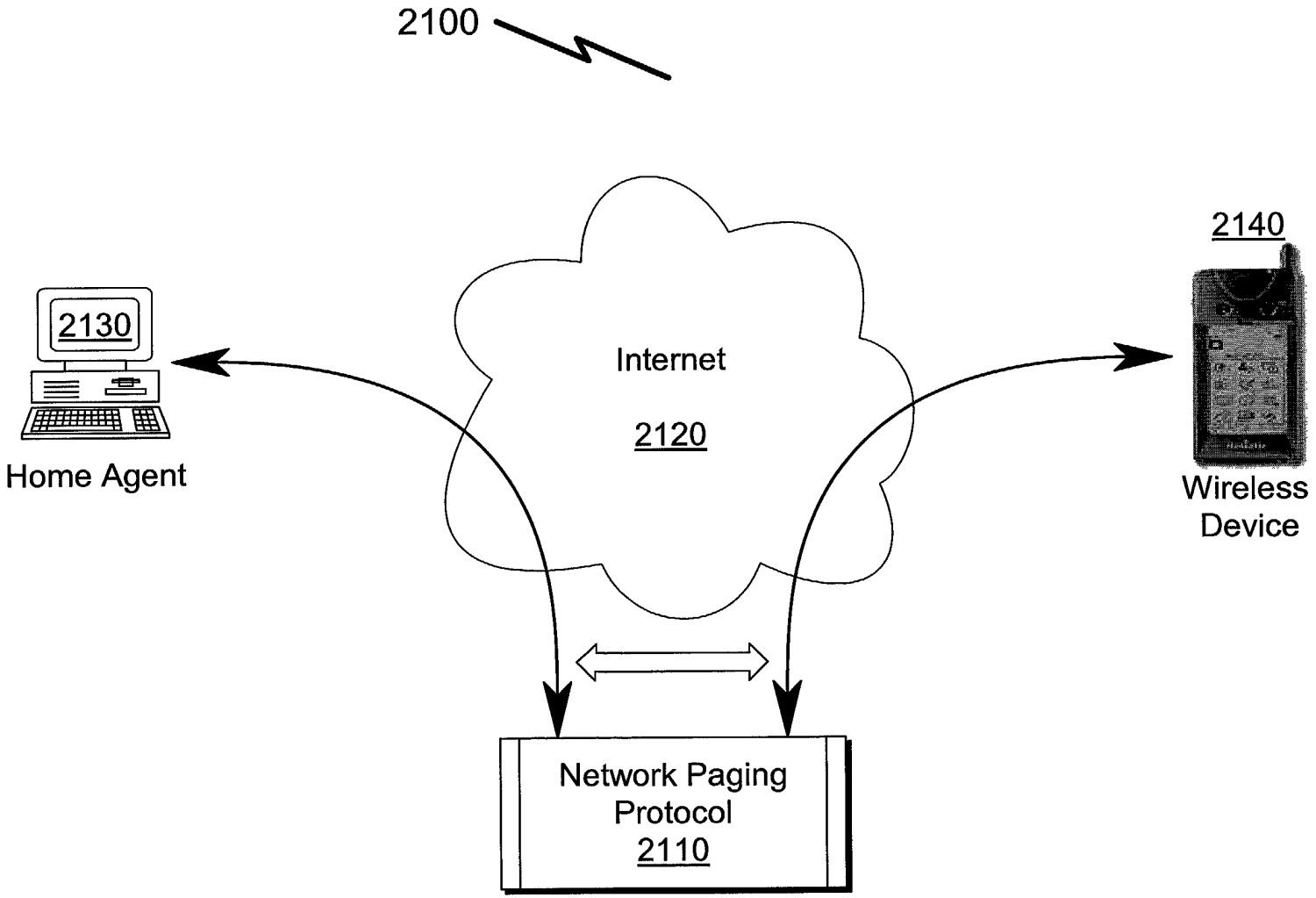

2100
2130
Home Agent
Internet
2120
2140
Wireless Device
Network Paging Protocol
2110

FIG. 22

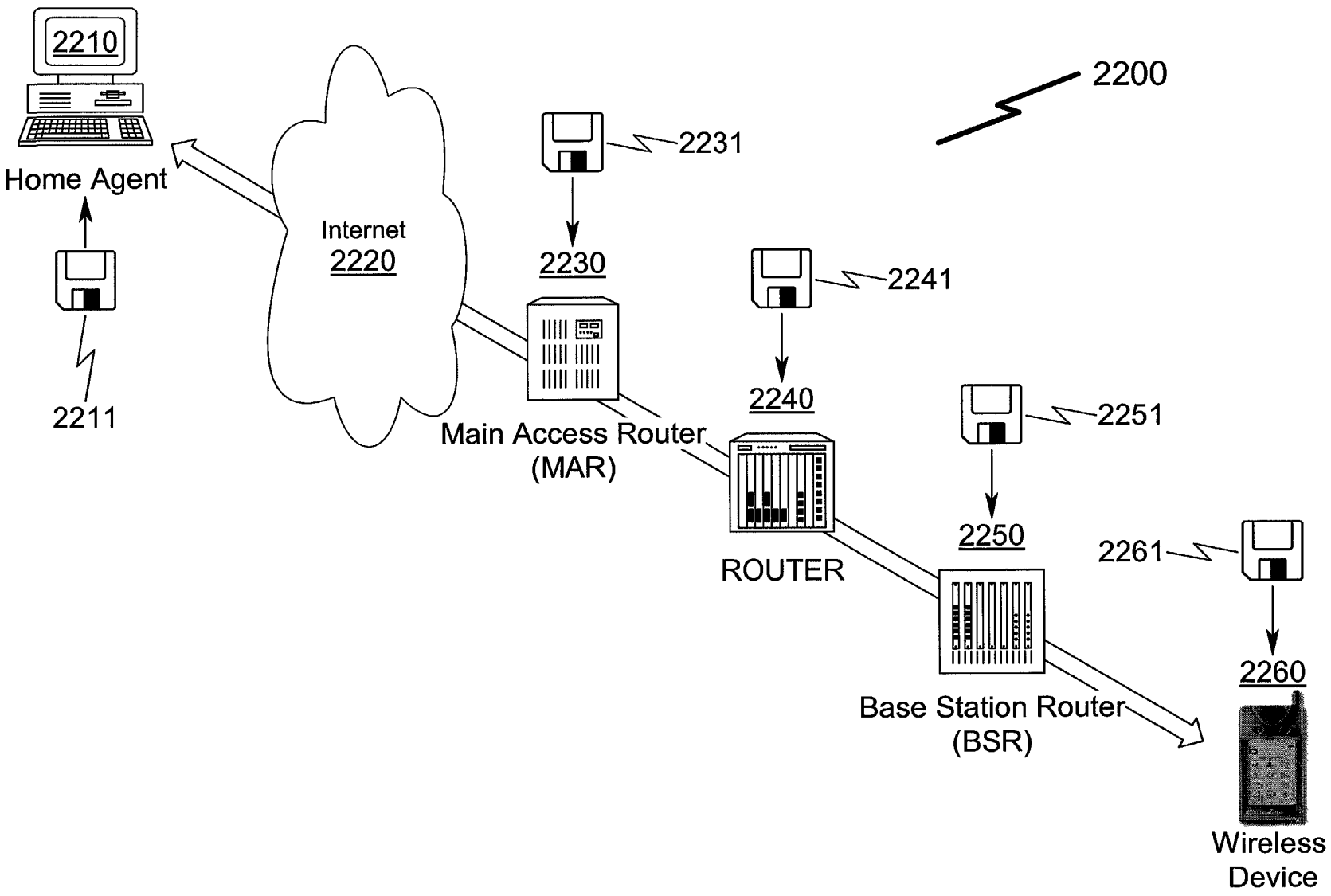

2210
Home Agent
2211
Internet
2220
2231
2230
2241
2240
2251
2250
2261
2260
2200
Main Access Router
(MAR)
ROUTER
Base Station Router
(BSR)
Wireless
Device

FIG. 23

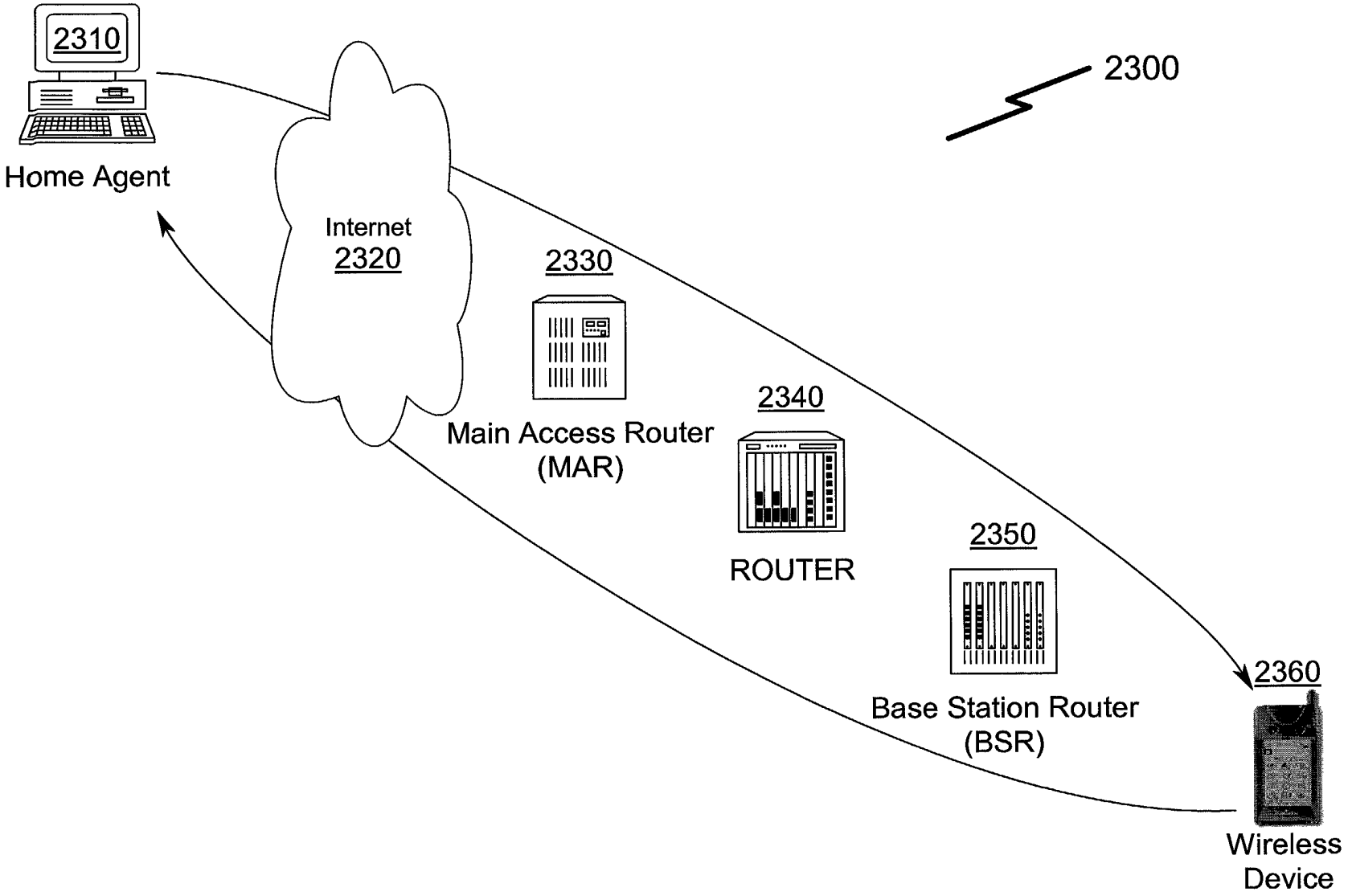
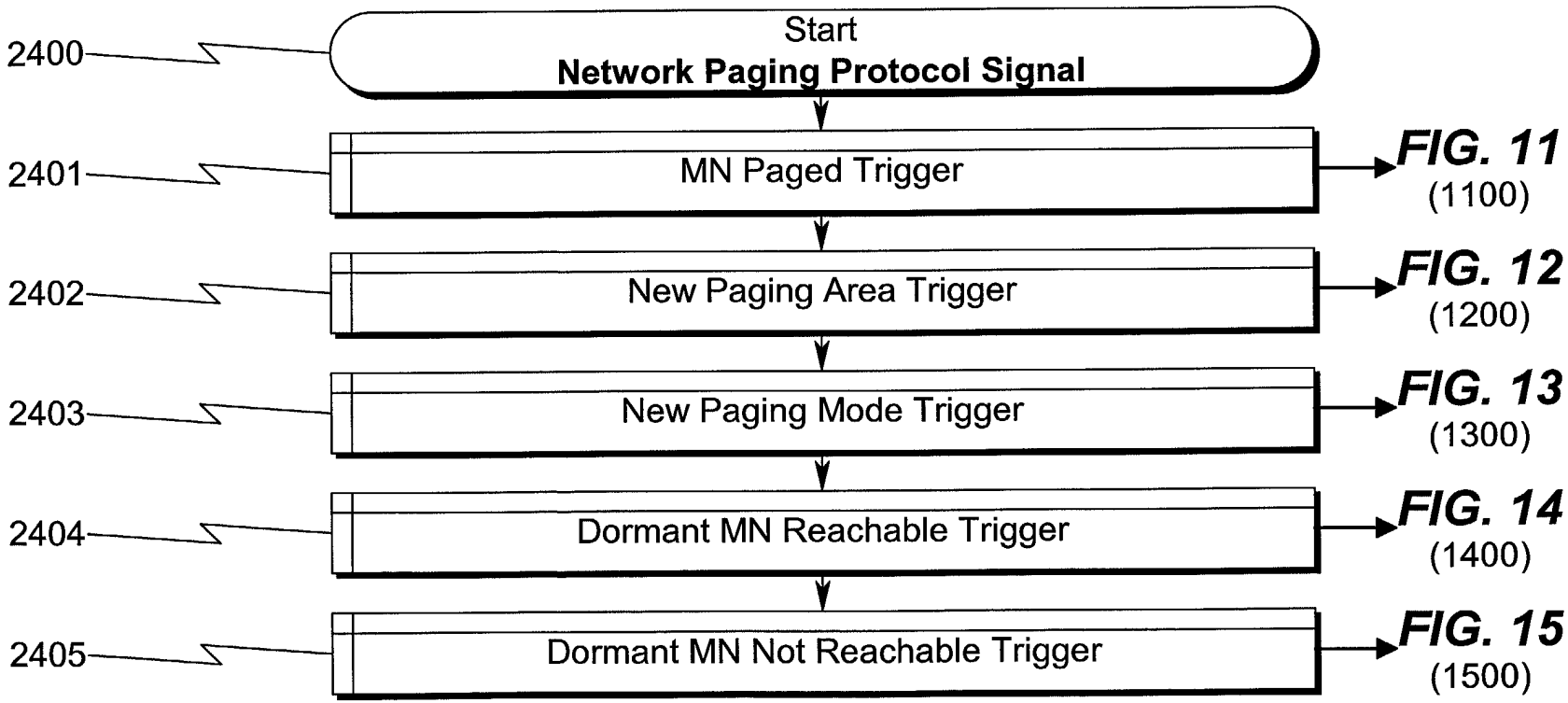

2310
Home Agent
Internet
2320
2330
Main Access Router
(MAR)
2340
ROUTER
2350
Base Station Router
(BSR)
2300
2360
Wireless
Device

FIG. 24


2400
Start
Network Paging Protocol Signal
2401
MN Paged Trigger
FIG. 11
(1100)
2402
New Paging Area Trigger
FIG. 12
(1200)
2403
New Paging Mode Trigger
FIG. 13
(1300)
2404
Dormant MN Reachable Trigger
FIG. 14
(1400)
2405
Dormant MN Not Reachable Trigger
FIG. 15
(1500)